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U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

DATE: February 22, 2002

EXPRESS MAIL LABEL NO.
EL71737775US

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U.S. APPLICATION NO.

10/069201

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

INTERNATIONAL APPLICATION NO.
PCT/DE00/02863

INTERNATIONAL FILING DATE
August 18, 2000

PRIORITY DATE CLAIMED
August 24, 1999

TITLE OF INVENTION

SWITCH TO BE MOUNTED ON A DESIGN ELEMENT IN THE PASSENGER COMPARTMENT OF A MOTOR VEHICLE

APPLICANT(S) FOR DO/EO/US

UEBELEIN, Joerg; ABERT, Carsten; and REXHAUSER, Bernd

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

- ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
- ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
- ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
- ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
- ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
 - ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - ☒ has been transmitted by the International Bureau.
 - ☐ is not required, as the application was filed in the United States Receiving Office (RO/LUS).
- ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
- ☒ A copy of the International Search Report (PCT/ISA/210).
- ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
 - ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - ☐ have been transmitted by the International Bureau.
 - ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - ☐ have not been made and will not be made.
- ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
- ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
- ☒ A copy of the International Preliminary Examination Report (PCT/PEA/409).
- ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 13 to 20 below concern document(s) or other information included:

- ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
- ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
- ☒ A FIRST preliminary amendment.
- ☐ A SECOND or SUBSEQUENT preliminary amendment.
- ☐ A substitute specification.
- ☐ A change of power of attorney and/or address letter.
- ☐ SMALL ENTITY Assertion: Applicant(s) and any other associated with it/them under 37 CFR § 1.27(a) are a small entity.
- ☒ Certificate of Mailing by Express Mail.
- ☒ Other items or information: A. Extra Set of Drawings. B. International Application and Annexes to IPER Incorporated.

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

EXPRESS MAIL NO. EL71737775US

Applicant : Joerg Uebelein, et al.
 Application No. : N/A
 Filed : February 22, 2002
 Title : SWITCH TO BE MOUNTED ON A DESIGN ELEMENT IN THE
 PASSENGER COMPARTMENT OF A MOTOR VEHICLE

Docket No. : 47861/DBP/M521

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
 Washington, D.C. 20231

Post Office Box 7068
 Pasadena, CA 91109-7068
 February 22, 2002

Commissioner:

Please amend the above-identified application as follows:

IN THE SPECIFICATION

After the title please add the following:

-- CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority of International application number PCT/DE00/02863, filed August 18, 2000, which in turn claims priority of German application number 199 40 172.1, filed August 24, 1999--.

IN THE CLAIMS

By this Amendment, Applicants are amending claims 3, 6-8, 10-12, and 17-26. Pending claims 1 to 26 follow.

1. Switch to be mounted on a design element in the passenger room of a motor vehicle, with
 - a haptic element (1, 1', 1'') which has at least one mechanical operating element (11) for the switch, and

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- electric and/or electronic switch elements (21, 21', 22, 22', 23, 24, 24') which are mounted on a flexible conductor (2, 2a, 2b),
wherein
- the haptic element (1, 1', 1'') acts on the switch elements (21, 21', 22, 22', 23, 24, 24') when the operating element (11) is actuated,
- the zone (20, 20') of the flexible conductor (2, 2a, 2b) supporting the switch elements (21, 21', 22, 22', 23, 24, 24') and an associated zone (11) of the haptic element (1, 1', 1'') are configured so that the corresponding zones (11, 20, 20') can be positioned and fixed relative to each other whilst no permanent electrical conductive connection is established between the flexible conductor (2, 2a, 2b) and the haptic element (1, 1', 1''),
- when positioning the zone (20, 20') of the flexible conductor (2, 2a, 2b) supporting the switch elements (21, 21', 22, 22', 23, 24, 24'), the switch elements (21, 21', 22, 22', 23, 24, 24') can be inserted into a socket (12, 120) of the haptic element (1, 1', 1'') which is provided with the operating element (11) so that a base body (10) of the haptic element (1, 1', 1'') together with the operating element (11) receives the switch elements (21, 21', 22, 22', 23, 24, 24') as they are inserted,
and
- as the switch elements (21, 21', 22, 22', 23, 24, 24') are inserted into the socket (12, 120) the switch elements (21, 21', 22, 22', 23, 24, 24') enter into active connection with the operating element (11) so that a switch signal is triggered during actuation of the operating element (11) by means of the switch elements (21, 21', 22, 22', 23, 24, 24').

2. Switch according to claim 1 characterised in that the haptic element (1, 1', 1'') cannot be brought into electrically conductive connection with the switch elements (21, 21', 22, 22', 23, 24, 24').

3. (Amended) Switch according to claim 1 characterised in that the haptic element (1, 1', 1'') has no electrically conductive component parts which can be coupled electrically with the switch elements (21, 21', 22, 22', 23, 24, 24').

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4. Switch according to claim 1 characterised in that the haptic element (1, 1', 1'') can only be brought into electrically conductive connection with the switch elements (21, 21', 22, 22', 23, 24, 24') by actuating an operating element (11) of the haptic element (1, 1', 1'').

5. Switch according to claim 4 characterised in that the electrically conductive connection only exists for as long as the switch is located in the switching state established by actuating the operating element (11).

6. (Amended) Switch according to claim 1, characterised in that the haptic element (1, 1', 1'') has no electrical structural elements apart from an electrical conductor.

7. (Amended) Switch according to claim 1, characterised in that the haptic element (1, 1', 1'') has as a single electrically conductive component which can be coupled electrically with the switch elements (21, 21', 22, 22', 23, 24, 24') a contact bridge with which an electrical connection can be established between two switch elements (21, 21', 22, 22', 23, 24, 24').

8. (Amended) Switch according to claim 1, characterised in that the relevant zones (11, 20, 20') of the conductor (2, 2a, 2b) and the haptic element (1) are formed as mechanical plug connectors wherein a base body (10) of the haptic element (1) has a socket zone (12) with which the zone (20, 20') of the flexible conductor (2) supporting the switch elements (21, 21', 22, 22') can be brought into positive engagement.

9. Switch according to claim 8 characterised in that the zone of the flexible conductor (2) supporting the switch elements (21, 21', 22, 22', 23, 24, 24') has a mechanical reinforcement (121, 122, 123, 124).

10. (Amended) Switch according to claim 9 characterised in that the mechanical reinforcement is formed as a frame (124) around the edges, a plate (123, 125) at the back or a cast element (121, 122) which surrounds the relevant zone (20).

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11. (Amended) Switch according to claim 9 characterised in that the mechanical reinforcement has at least one detent element (125b) for securing the insert position in respect of the haptic element and/or means (125a) for sealing the plug zone against damp.

12. (Amended) Switch according to claim 1 characterised in that the relevant zones (11, 20') of the conductor (2) and haptic element (1', 1'') are formed as clamp-fit connections wherein a base body (10) of the haptic element (1', 1'') has a socket zone (120) and a fixing element (12', 12'') connectable therewith so that the zone (20') of the flexible conductor (2) supporting the switch elements (22, 22') can be clamped between the socket zone (120) of the haptic element and the fixing element (12', 12'').

13. Switch according to claim 12 characterised in that the fixing element (12') is connected in one piece with the base body (10) through a film hinge (12b) of a plastics base body (10) of the haptic element (1').

14. Switch according to claim 11 characterised in that the fixing element (12'') is formed as a separate clamping plate.

15. Switch according to claim 12 characterised in that means are provided for positioning the zone of the flexible conductor supporting the switch elements relative to the base body of the haptic element.

16. Switch according to claim 15 characterised in that the positioning means are formed on the part of the flexible conductor (2) in the form of recesses (126) and on the part of the base member of the haptic element in the form of corresponding studs or the like.

17. (Amended) Switch according to claim 1 characterised in that the switch elements (22, 22') provided on the flexible conductor (2) are formed as electrical contact faces which are allocated an electrical contact bridge which is connected to an operating element (11) of the haptic element (1) and which when the operating element (11) is actuated closes the electrical circuit.

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18. (Amended) Switch according to claim 1 characterised in that the switch elements (24, 24') provided on the flexible conductor (2) are provided in boxes, e.g. in the form of SMD switches or switch mats.

19. (Amended) Switch according to claim 1 characterised in that the switch elements provided on the flexible conductor (2) are designed as magneto-resistive structural elements (e.g. Hall elements) which are each allocated a permanent magnet which is connected to an actuating element of the haptic element.

20. (Amended) Switch according to claim 1 characterised in that the switch elements provided on the flexible conductor (2) are formed as inductive or capacitive close range approach switches.

21. (Amended) Switch according to claim 1, characterised in that the switch elements provided on the flexible conductor (2) are formed as transponder readers.

22. (Amended) Switch according to claim 1 characterised in that the switch elements provided on the flexible conductor (2) are formed as passive or active optical elements allocated on the part of the operating elements of the haptic element means for reflection for the purpose of establishing a visual transmission path or means for interrupting a visual transmission path.

23. (Amended) Switch according to claim 1 characterised in that further structural elements (3a, 3b) such as for example an optical element for illuminating the switch, a micro controller, resistances, diodes or the like, are mounted on the zone (20) of the flexible conductor (2) supporting the switch elements.

24. (Amended) Switch according to claim 1 characterised in that the zone (20) supporting the switch elements is detachably connected to the haptic element (1, 1', 1'').

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25. (Amended) Switch according to claim 1 characterised in that the switch has in addition to the switch elements (21, 21', 22, 22', 23, 24, 24') also further electrical and/or electronic structural elements.

26. (Amended) Switch according to claim 1 characterised in that the zone (11) of the haptic element (1, 1', 1'') associated with the switch elements (21, 21', 22, 22', 23, 24, 24') forms at the same time at least one operating element of the haptic element (1, 1', 1'').

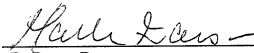
REMARKS

Claims 1-26 remain in the application. Claims 3, 6-8, 10-12, and 17-26 have been amended. It is respectfully requested that the foregoing preliminary amendment be entered prior to examination.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

Respectfully submitted,

CHRISTIE, PARKER & HALE, LLP

By  #311953
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Reg. No. 20,958
626/795-9900

DBP/aam

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

3. (Amended) Switch according to claim 1 [~~or 2~~] characterised in that the haptic element (1, 1', 1'') has no electrically conductive component parts which can be coupled electrically with the switch elements (21, 21', 22, 22', 23, 24, 24').

6. (Amended) Switch according to claim 1, [~~4 or 5~~] characterised in that the haptic element (1, 1', 1'') has no electrical structural elements apart from an electrical conductor.

7. (Amended) Switch according to claim 1, [~~4, 5 or 6~~] characterised in that the haptic element (1, 1', 1'') has as a single electrically conductive component which can be coupled electrically with the switch elements (21, 21', 22, 22', 23, 24, 24') a contact bridge with which an electrical connection can be established between two switch elements (21, 21', 22, 22', 23, 24, 24').

8. (Amended) Switch according to [~~one of the preceding claims~~] claim 1, characterised in that the relevant zones (11, 20, 20') of the conductor (2, 2a, 2b) and the haptic element (1) are formed as mechanical plug connectors wherein a base body (10) of the haptic element (1) has a socket zone (12) with which the zone (20, 20') of the flexible conductor (2) supporting the switch elements (21, 21', 22, 22') can be brought into positive engagement.

10. (Amended) Switch according to [~~claims 8 and 9~~] claim 9 characterised in that the mechanical reinforcement is formed as a frame (124) around the edges, a plate (123, 125) at the back or a cast element (121, 122) which surrounds the relevant zone (20).

11. (Amended) Switch according to [~~one of the preceding claims~~] claim 9 characterised in that the mechanical reinforcement has at least one detent element (125b) for securing the insert position in respect of the haptic element and/or means (125a) for sealing the plug zone against damp.

12. (Amended) Switch according to [~~one of claims 1 to 7~~] claim 1 characterised in that the relevant zones (11, 20') of the conductor (2) and haptic element (1', 1'') are formed as clamp-fit

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connections wherein a base body (10) of the haptic element (1', 1'') has a socket zone (120) and a fixing element (12', 12'') connectable therewith so that the zone (20') of the flexible conductor (2) supporting the switch elements (22, 22') can be clamped between the socket zone (120) of the haptic element and the fixing element (12', 12'').

17. (Amended) Switch according to ~~[one of the preceding claims]~~ claim 1 characterised in that the switch elements (22, 22') provided on the flexible conductor (2) are formed as electrical contact faces which are allocated an electrical contact bridge which is connected to an operating element (11) of the haptic element (1) and which when the operating element (11) is actuated closes the electrical circuit.

18. (Amended) Switch according to ~~[one of the preceding claims]~~ claim 1 characterised in that the switch elements (24, 24') provided on the flexible conductor (2) are provided in boxes, e.g. in the form of SMD switches or switch mats.

19. (Amended) Switch according to ~~[one of the preceding claims]~~ claim 1 characterised in that the switch elements provided on the flexible conductor (2) are designed as magneto-resistive structural elements (e.g. Hall elements) which are each allocated a permanent magnet which is connected to an actuating element of the haptic element.

20. (Amended) Switch according to ~~[one of the preceding claims]~~ claim 1 characterised in that the switch elements provided on the flexible conductor (2) are formed as inductive or capacitive close range approach switches.

21. (Amended) Switch according to ~~[one of the preceding claims]~~ claim 1, characterised in that the switch elements provided on the flexible conductor (2) are formed as transponder readers.

22. (Amended) Switch according to ~~[one of the preceding claims]~~ claim 1 characterised in that the switch elements provided on the flexible conductor (2) are formed as passive or active optical elements allocated on the part of the operating elements of the haptic element means for

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reflection for the purpose of establishing a visual transmission path or means for interrupting a visual transmission path.

23. (Amended) Switch according to [~~one of the preceding claims~~] claim 1 characterised in that further structural elements (3a, 3b) such as for example an optical element for illuminating the switch, a micro controller, resistances, diodes or the like, are mounted on the zone (20) of the flexible conductor (2) supporting the switch elements.

24. (Amended) Switch according to [~~one of the preceding claims~~] claim 1 characterised in that the zone (20) supporting the switch elements is detachably connected to the haptic element (1, 1', 1").

25. (Amended) Switch according to [~~one of the preceding claims~~] claim 1 characterised in that the switch has in addition to the switch elements (21, 21', 22, 22', 23, 24, 24') also further electrical and/or electronic structural elements.

26. (Amended) Switch according to [~~one of the preceding claims~~] claim 1 characterised in that the zone (11) of the haptic element (1, 1', 1") associated with the switch elements (21, 21', 22, 22', 23, 24, 24') forms at the same time at least one operating element of the haptic element (1, 1', 1").

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SWITCH TO BE MOUNTED ON A DESIGN ELEMENT IN THE PASSENGER
COMPARTMENT OF A MOTOR VEHICLE

SUBSTITUTE SPEC

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Description

- 10 The invention relates to a switch to be mounted on a design element in the passenger compartment of a motor vehicle according to the preamble of patent claim 1. The switch according to the invention is characterised by a simple secure assembly process as well as by its
- 15 significant lack of dependence on the design of the haptic element.

- By haptic element is meant a structural group of the switch which contains the mechanical operating elements required for manually operating the switch. The haptic
- 20 element can furthermore serve as a visual element, eg by suitably configuring the haptic element it is possible to make the function of the switch visible to the user.

- 25 From DE 197 38 656 A1 a switch is already known whose electrical or electronic switch elements and whose associated operating elements in the haptic element are positioned independently of each other on various parts of the vehicle door. They only come into active connection
- 30 after the two parts have been fitted together. The drawback here however is that it is necessary to ensure a very close tolerance of the parts which support the switch element and haptic element which are to be connected together otherwise faulty positioning may have to be taken
- 35 into account.

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DE 43 13 030 A1 and US 5 805 402 describe groups of switches based on flexible printed conductors. They consist essentially of electrical switch elements which can preferably be in cases which are assigned a flexible foil touch panel or separate operating elements held in a console. Even with this technical solution bringing together the electrical switch elements and the haptic element requires considerable effort and great care. Furthermore switch blocks of this kind combined into groups considerably restrict the freedom of design since the geometrical arrangement of the individual switch elements determines the positioning of the operating elements of the haptic element. With many design specifications, such as are customary in the automotive industry, there is a great degree of variation in the foil-bound switch elements, unless one always proceeds from the variation having the highest design specification and does not connect up the corresponding switches where the design specifications are lower. However this leads to an undesirably high use of resources.

The object of the invention is to provide a switch to be mounted on a design element in the passenger compartment of a motor vehicle, for example on the inner trim of a door, which is cost-effective to manufacture and which can be fitted simply and securely and which can be adapted to any desired design.

According to the invention this is achieved through the features of patent claim 1.

According to this the zones of the flexible conductor which support the switch elements, and the zones or operating elements of the haptic element which are associated with these zones are designed so that the relevant zones can be positioned and fixed relative to each other and can be detached from each other. Furthermore these zones have no means for establishing a

permanent electrical circuit connection. Thus no permanent electrical contact is produced between the zones on the two sides.

- 5 The term "electrical" and "electronic" switch elements is thereby to include electro-magnetic and electro-optical switch elements.

- 10 According to a variation of the invention it is hereby proposed that the haptic element cannot be brought into an electrically conductive connection with the switch elements, i.e. the haptic element has no electrically conductive component parts which can be coupled electrically with the switch elements.

- 15 According to another variation of the invention the haptic element can only be brought into electrically conductive connection with the switch elements by actuating an operating element of the haptic element whereby the
20 electrically conducting connection only exists for as long as the switch is located in the switching state produced by actuating the operating element ("switch closed"). With this variation of the invention the haptic element has no electrical structural elements in the narrower
25 sense (such as e.g. a resistance, a transistor etc), but only a contact bridge in the form of a simple electrical conductor with which an electrical connection can be established between two switch elements.

- 30 According to a preferred embodiment of the invention the relevant zones of the conductor and haptic element are formed as mechanical plug connectors wherein a base member of the haptic element has a socket zone, such as e.g. a
35 plug opening with which the zone of the flexible conductor supporting the switch elements can be brought into positive keyed engagement. To this end the zones of the flexible conductor supporting the switch elements has a mechanical reinforcement in the form of a frame around the

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edges, a plate at the back or a cast element incorporating the relevant zone.

5 A cast element is suitable when using contactless switch systems, such as magneto-resistive sensors or inductive and capacitive close-range approach sensors. The cast element thereby offers in addition to good protection against mechanical damage also excellent protection against chemical attack and obviously against damp. This
10 in turn guarantees that the switch has a high reliability and long service life.

Through suitably configuring the reinforcement which is connected to the flexible conductor, and also the close-
15 fitting corresponding socket opening in the haptic element, the plug connection can only be established in the proposed position. Forming the reinforcement, whether it is by sticking a plate onto the reverse side of the conductor or by injection moulding a frame round the edge
20 of the conductor or by casting the end region of the conductor, can be undertaken with high precision and efficiency by automated machines.

The mechanical reinforcements can also have detent
25 elements for securing the insert position with regard to the haptic element, as well as means for sealing the plug-in zone against damp. When manufacturing such components it is possible to use twin component plastics injection moulding technology so that it is easier to meet the
30 demands required for a seal through the softer of the two plastics.

A further embodiment of the invention proposes designing the zones of the flexible conductor supporting the
35 switches, and the associated zone of the haptic element as a clamp-fit connection whereby a base body of the haptic element has a socket zone and a fixing element connectable therewith so that the zone of the flexible conductor

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supporting the switch elements can be clamped between the socket zone of the haptic element and the fixing element. This can be undertaken for example by a fixing element which is connected in one piece with the base body through
5 a film hinge of a plastics base body of the haptic element. After the corresponding zone of the flexible conductor has been supplied to the socket zone of the base body the fixing element can be swivelled towards the socket zone until its position is secured through detent
10 elements and the conductor is thereby fixed with the switch elements relative to the position of the operating elements.

A further development of this embodiment proposes using a
15 separate clamping plate as the fixing element. In this case the clamping plate should be provided with positive locking elements (e.g. studs) which are associated with matching detent openings (preferably around the edge) of the flexible conductor. These positive locking elements
20 can be arranged so that only an exact positioning is possible between the clamping plate and conductor. The clamping plate is then fixed on the base body of the haptic element by means of a snap-fitting connection.

25 Basically all types of switch elements can be used if they are suitable for fitting flexible printed conductors. These can be formed for example as electrical contact faces which are allocated an electrical contact bridge which is connected to an operating element of the haptic
30 element and closes the electric circuit when the operating element is actuated. Apart from the inductive and capacitive close-range approach switches and magneto-resistive structural elements (e.g. Hall element) already mentioned and which are each assigned a ferro-magnetic
35 metal plate or a permanent magnet connected to an operating element of the haptic element, boxed switch elements are also suitable in the form of SMD switches or switch mats. Furthermore transponder readers are also

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suitable as switch elements. Which type of switch is selected by the technician depends decisively on the technical requirements in each individual case.

5 At this point it should be pointed out that non-electrical principles can be used. By way of example the switch elements provided on the flexible conductor can be formed as passive or active optical elements which are assigned on the side of the operating elements of the haptic
10 element means for reflection for the purpose of establishing an optical transmission path or means for interrupting an optical transmission path. Further processing of the switch signal is undertaken through the interposition of an opto-electrical converter.

15 Next to the switch elements there are where necessary further structural elements such as for example an optical element for lighting up the switch, a micro controller, resistances, diodes or the like.

20 The invention utilises the principle of the plug connection in order to establish in a simple reliable way an active connection between the switch elements and the operating elements of the haptic element without using at
25 the same time (permanent-acting) electrical cable connections which are liable to breakdown. The configuration of the zones of the flexible conductor supporting the switch elements is entirely secondary to the configuration of the haptic element whilst
30 simultaneously reducing the variety of designs on the switch side. I.e by means of the technical solution according to the invention (theoretically) any number of geometric arrangements of the operating elements of the haptic element can be fitted with only one variation of
35 cable harness.

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The invention will now be explained in further detail with reference to the embodiments shown in the drawings in which:

- 5 Figure 1 shows a flexible conductor with a reinforcement formed as a plate on the reverse side as well as boxed switch elements on the front side and haptic element with operating elements prior to connection with the switch;
- 10 Figure 2 is as Figure 1, but with electrical contact faces as the switch element;
- Figure 3 shows a flexible conductor for clamp fitting on the base body of the haptic element by means of a clamping plate which is swivel mounted on the base body and can be locked therewith;
- 15 Figure 4 similar to Figure 3, but with a separate clamping plate;
- Figure 5 shows a diagrammatic illustration of a flexible conductor with a close-range approach switch or the like wherein the plug area is formed by a cast element;
- 20 Figure 6 shows a diagrammatic view of a flexible conductor with switch elements in the form of a boxed touch panel and a plug zone formed as a cast element wherein the cast element has recesses in the region of the touch panel;
- 25 Figure 7 shows a diagrammatic view of a flexible conductor with a reinforcement plate stuck onto the underneath to form the plug zone;

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Figure 8 shows a diagrammatic view of a flexible conductor with a plug zone formed by a frame around the edge;

5 Figure 9 shows a diagrammatic view of a flexible conductor with a plate moulded onto the underneath and with a sealing element closing the plug zone, as well as with detent elements fixing the plug-in position in the haptic element;

10 Figure 10 shows a diagrammatic view of a flexible conductor with a clamping zone which has perforations for positioning the switch elements accurately relative to the haptic element;

15 Figure 11 shows a diagrammatic view of a flexible conductor which is divided up into three arms with plug zones at the ends for different functioning units.

20 Mounting electrical and electronic structural elements 3a, 3b, 21, 22, 23, 24 on flexible conductor plates or conductors 2, 2a, 2b, 2c is carried out by automatic manufacturing equipment which can be adapted to the various different requirements of the component parts which are to be fitted. Thus it can also be envisaged
25 that the plug zones 20 or clamping zones 20' can be formed in the same production line. The relevant zones are then immediately available for connecting to a suitably adapted haptic element.

30 Figure 1 shows a flexible conductor 2 having conducting paths 200 to which are connected two boxed switch elements 21, 21' (constructed as buttons) and an optical element 3a (e.g. light diode) for illuminating the switch. On the back of the conductor 2 there is a reinforcement 123 in
35 the form of a plate which is stuck on and stabilises the plug zone 20 which supports the switch elements 21, 21' and is associated with a slit-like plug zone 12 of the base body 10 of the haptic element 11. Detent and sealing

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elements can, analogous with Figure 9, be connected to the reinforcement 123 to ensure secure fixing of the plug zone 20 in the haptic element as well as an effective seal against damp.

5 After introducing the plug zone 20 into the socket zone 12 of the base body 10 of the haptic element 1 an active connection is established between the switch elements 21, 21' and the operating element 11. If finger pressure is
10 applied to one of the zones of the operating element 11 marked by the arrows ((or () then this zone flips in the direction of the corresponding switch element 21 or 21' and thereby actuates the sensor element 21a which leads to a switch signal. Once the operating pressure has ceased
15 the operating element 11 automatically returns to its starting position whereby the switch signal is interrupted.

20 The embodiment of Figure 2 corresponds substantially to that of Figure 1. Only the switch elements 22, 22' are designed as electrical contact faces which are each assigned a contact bridge (not shown) from the inside of the operating element 11. A switch signal is thus produced by short-circuiting the adjoining and slightly
25 spaced contact faces 22 and 22'. When using this embodiment in surroundings which are susceptible to damp and possibly to particles of dirt, e.g. in the wet space of a vehicle door, a seal has to be provided around the edge of the socket area 12 of the haptic element 1. For
30 this not only are the means available which are already mentioned in the description relating to Figure 1, but also there is the possibility of integrating a seal (e.g. through 2-component injection moulding) in the base body 10 of the haptic element since the switch elements 22
35 which are formed as contact faces do not really cause any extra thickness compared with the boxed switch elements 21 (see Figure 1) which might hinder the insertion of the plug zone 20 into the base body 10.

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The variation of the invention shown in Figure 3 uses a clamping connection instead of a plug-in connection between the conductor 2 and haptic element. According to
5 the variation here a fixing element 12' designed as a clamping plate is attached to the base body 10 of the haptic element 1' through a film hinge 12b and after positioning the clamping zone 20 of the flexible conductor
10 1' the fixing element can be fixed on the base body 10 through the detent elements 10a, 12a. This produces a clamping fixing of the conductor 2 on the haptic element 1'. The film hinge 12b could be used as a stop for correctly positioning the conductor 2.

15 As opposed to this, the switch in Figure 4 uses a separate fixing element 12'' which should preferably be provided with positive locking elements (not shown) which can engage in positioning openings of the flexible conductor
20 (analogous with Figure 10). After clipping the fixing element 12'' onto the base body 1' a permanently correct positioning of the switch elements 22, 22' relative to the operating element 11 is guaranteed.

25 When using a clamping connection between the zone 20' and the base body 10 a mechanical reinforcement is no longer required.

30 Figure 5 shows a mechanical reinforcement 121 in the form of a case element (e.g. based on an epoxy resin or plastics) which completely encases the plug zone and in which an electronic contactlessly operating switch 23 (e.g. Hall element) is embedded which reacts to close
35 range approach of the associated zone of the operating element 11 or a part connected thereto. Furthermore an optical element is provided for illuminating the switch.

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In the embodiment of Figure 6 recesses were provided in the case element 122 in the region of the switch elements 24, 24' formed as buttons (analogous with Figure 1), to allow access and thus operation through the operating element 11. Depending on requirements further electronic structural elements 3b are included in the cast element. In order to reliably avoid a false execution of the plug fitting process the contours of the mechanical reinforcements 121, 122, 123, 124, 125 and socket openings 12 of the base body 10 should be matched with each other along the lines of the key principle.

Figure 7 corresponds substantially to a combination of the mechanical reinforcement 123 of Figure 1 and the fitting out of electronic structural elements according to Figure 5.

Figure 8 shows a mechanical reinforcement in the form of a frame 124 which is connected to the side edge of the conductor 2, for example by injection moulding or even by sticking.

The reinforcement shown in Figure 9 consists of a plate 125 connected to the underneath of the conductor and provided on its inner edge with a moulded seal 125a having detent elements 125b. In conjunction with a haptic element similar to Figure 1 and adapted detent elements of the base body it is possible to guarantee a permanent secure positioning of the switch elements 22, 22' relative to the operating element 11. The seal 125a keeps out dirt and damp from the electrical and electronic structural elements.

One example of a flexible conductor 2 for clamp fixing on a haptic element is shown in Figure 10. According to this perforations 126 are formed in the clamping area 20' of the conductor 2 and are associated with detent pins (not shown) on a fixing element 12''. The different patterns of perforations 126 in the two edges guarantees accurate positioning of the conductor 2 relative to the fixing element 12'' and thus also to the operating element 11.

- 10 The diagrammatic illustration of Figure 11 shows a conductor 2 split up into three conductor arms 2a, 2b, 2c. The end zones 4, 5, 6, 7 are each assigned different functions. For a cable inserted in a vehicle door on the drive side for example the zone could be connected to a
- 15 switch module which is provided for operating the front and rear window lifters, the mirror and the child lock. Unlocking the petrol tank could be assigned to the zone 5 of the conductor arm 2b. Finally the zones 6 and 7 can be connected to indicator instruments showing the state of
- 20 the door locks.

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LIST OF REFERENCE NUMERALS

	1	Haptic element
	1'	Haptic element
5	1''	Haptic element
	10	Base body of haptic element
	10a	Detent element
	11	Operating element, sensor button
10	12	Socket zone, plug zone
	12'	Fixing element; plate, integrated and swivel mounted in base body
	12''	Fixing element; plate, separate
	12a	Detent element
15	120	Socket zone
	121	Cast element
	122	Cast element
	123	Reinforcement element, full surface on one side
20	124	Reinforcement element, around the edges
	125	Reinforcement element, full surface on one side
	125a	Sealing element
	125b	Detent element, clip element
	126	Positioning means, recess, perforation
25	2	Flexible conductor
	2a	Flexible conductor
	2b	Flexible conductor
	20	Zone supporting switch elements; plug zone
30	20'	Zone supporting switch elements; clamping zone
	21	Switch element
	21a	Sensor element
	22	Switch element
	23	Switch element
35	24	Switch element
	200	Conductor path

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- 3a Optical element
- 3b Electronic component part (any type)
- 4 Zone associated with haptic element
- 5 Zone associated with haptic element
- 6 Zone associated with haptic element
- 10 7 Zone associated with haptic element

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1. Switch to be mounted on a design element in the passenger room of a motor vehicle, with
- 5 - a haptic element (1, 1', 1'') which has at least one mechanical operating element (11) for the switch, and
- electric and/or electronic switch elements (21, 21', 22, 22', 23, 24, 24') which are mounted on a flexible conductor (2, 2a, 2b),
- 10 wherein
- the haptic element (1, 1', 1'') acts on the switch elements (21, 21', 22, 22', 23, 24', 24') when the operating element (11) is actuated,
- the zone (20, 20') of the flexible conductor (2, 2a, 2b) supporting the switch elements (21, 21', 22, 22', 23, 24, 24') and an associated zone (11) of the haptic element (1, 1', 1'') are configured so that the corresponding zones (11, 20, 20') can be positioned and fixed relative to each other whilst no permanent electrical conductive connection is established between the flexible conductor (2, 2a, 2b) and the haptic element (1, 1', 1''),
- 20
- when positioning the zone (20, 20') of the flexible conductor (2, 2a, 2b) supporting the switch elements (21, 21', 22, 22', 23, 24, 24'), the switch elements (21, 21', 22, 22', 23, 24, 24') can be inserted into a socket (12, 120) of the haptic element (1, 1', 1'') which is provided with the operating element (11) so
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that a base body (10) of the haptic element (1, 1', 1'') together with the operating element (11) receives the switch elements (21, 21', 22, 22', 23, 24, 24') as they are inserted,

5 and

- as the switch elements (21, 21', 22, 22', 23, 24, 24') are inserted into the socket (12, 120) the switch elements (21, 21', 22, 22', 23, 24, 24') enter into active connection with the operating element (11) so that a
10 switch signal is triggered during actuation of the operating element (11) by means of the switch elements (21, 21', 22, 22', 23, 24, 24').

PATENT CLAIMS

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- ~~1. Switch to be mounted on a design element in the~~
5 ~~passenger compartment of a motor vehicle, with~~
~~- a haptic element which has at least one mechanical~~
~~operating element for the switch, and~~
~~- electric and/or electronic switch elements which are~~
~~mounted on a flexible conductor,~~
10 ~~wherein the haptic element acts on the switch elements~~
~~when the operating element is actuated,~~

characterised in that

- 15 ~~the zone (20) of the flexible conductor (2, 2a, 2b)~~
~~supporting the switch elements (21, 21', 22, 22', 23, 24,~~
~~24') and an associated zone (11) of the haptic element (1,~~
~~1', 1'') are configured so that the corresponding zones~~
~~(11, 20) can be positioned and fixed relative to each~~
20 ~~other whilst no permanent electrical conductive connection~~
~~is established between the flexible conductor (2, 2a, 2b)~~
~~and the haptic element (1, 1', 1'').~~

2. Switch according to claim 1 **characterised in that** the
25 haptic element (1, 1', 1'') cannot be brought into
electrically conductive connection with the switch
elements (21, 21', 22, 22', 23, 24, 24').

3. Switch according to claim 1 or 2 **characterised in that**
30 the haptic element (1, 1', 1'') has no electrically
conductive component parts which can be coupled
electrically with the switch elements (21, 21', 22, 22',
23, 24, 24').

4. Switch according to claim 1 **characterised in that** the haptic element (1, 1', 1'') can only be brought into electrically conductive connection with the switch elements (21, 21', 22, 22', 23, 24, 24') by actuating an operating element (11) of the haptic element (1, 1', 1'').

5. Switch according to claim 4 **characterised in that** the electrically conductive connection only exists for as long as the switch is located in the switching state established by actuating the operating element (11).

6. Switch according to claim 1, 4 or 5 **characterised in that** the haptic element (1, 1', 1'') has no electrical structural elements apart from an electrical conductor.

7. Switch according to claim 1, 4, 5 or 6 **characterised in that** the haptic element (1, 1', 1'') has as a single electrically conductive component which can be coupled electrically with the switch elements (21, 21', 22, 22', 23, 24, 24') a contact bridge with which an electrical connection can be established between two switch elements (21, 21', 22, 22', 23, 24, 24').

8. Switch according to one of the preceding claims, **characterised in that** the relevant zones (11, 20, 20') of the conductor (2, 2a, 2b) and the haptic element (1) are formed as mechanical plug connectors wherein a base body (10) of the haptic element (1) has a socket zone (12) with which the zone (20, 20') of the flexible conductor (2) supporting the switch elements (21, 21', 22, 22') can be brought into positive engagement.

9. Switch according to claim 8 **characterised in that** the zone of the flexible conductor (2) supporting the switch elements (21, 21', 22, 22', 23, 24, 24') has a mechanical reinforcement (121, 122, 123, 124).

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10. Switch according to claims 8 and 9 **characterised in that** the mechanical reinforcement is formed as a frame (124) around the edges, a plate (123, 125) at the back or a cast element (121, 122) which surrounds the relevant zone (20).

11. Switch according to one of the preceding claims **characterised in that** the mechanical reinforcement has at least one detent element (125b) for securing the insert position in respect of the haptic element and/or means (125a) for sealing the plug zone against damp.

12. Switch according to one of claims 1 to 7 **characterised in that** the relevant zones (11, 20') of the conductor (2) and haptic element (1', 1'') are formed as clamp-fit connections wherein a base body (10) of the haptic element (1', 1'') has a socket zone (120) and a fixing element (12', 12'') connectable therewith so that the zone (20') of the flexible conductor (2) supporting the switch elements (22, 22') can be clamped between the socket zone (120) of the haptic element and the fixing element (12', 12'').

13. Switch according to claim 12 **characterised in that** the fixing element (12') is connected in one piece with the base body (10) through a film hinge (12b) of a plastics base body (10) of the haptic element (1').

14. Switch according to claim 11 **characterised in that** the fixing element (12'') is formed as a separate clamping plate.

15. Switch according to claim 12 **characterised in that** means are provided for positioning the zone of the flexible conductor supporting the switch elements relative to the base body of the haptic element.

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16. Switch according to claim 15 **characterised in that** the positioning means are formed on the part of the flexible conductor (2) in the form of recesses (126) and on the part of the base member of the haptic element in
5 the form of corresponding studs or the like.

17. Switch according to one of the preceding claims **characterised in that** the switch elements (22, 22') provided on the flexible conductor (2) are formed as
10 electrical contact faces which are allocated an electrical contact bridge which is connected to an operating element (11) of the haptic element (1) and which when the operating element (11) is actuated closes the electrical circuit.

18. Switch according to one of the preceding claims **characterised in that** the switch elements (24, 24') provided on the flexible conductor (2) are provided in
15 boxes, e.g. in the form of SMD switches or switch mats.

19. Switch according to one of the preceding claims **characterised in that** the switch elements provided on the flexible conductor (2) are designed as magneto-resistive structural elements (e.g. Hall elements) which are each
20 allocated a permanent magnet which is connected to an actuating element of the haptic element.

20. Switch according to one of the preceding claims **characterised in that** the switch elements provided on the
30 flexible conductor (2) are formed as inductive or capacitive close range approach switches.

21. Switch according to one of the preceding claims, **characterised in that** the switch elements provided on the
35 flexible conductor (2) are formed as transponder readers.

22. Switch according to one of the preceding claims **characterised in that** the switch elements provided on the

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flexible conductor (2) are formed as passive or active optical elements allocated on the part of the operating elements of the haptic element means for reflection for the purpose of establishing a visual transmission path or
5 means for interrupting a visual transmission path.

23. Switch according to one of the preceding claims **characterised in that** further structural elements (3a, 3b) such as for example an optical element for illuminating the switch, a micro controller, resistances, diodes or the like, are mounted on the zone (20) of the flexible conductor (2) supporting the switch elements.
10

24. Switch according to one of the preceding claims **characterised in that** the zone (20) supporting the switch elements is detachably connected to the haptic element (1, 1', 1'').
15

25. Switch according to one of the preceding claims **characterised in that** the switch has in addition to the switch elements (21, 21', 22, 22', 23, 24, 24') also further electrical and/or electronic structural elements.
20

26. Switch according to one of the preceding claims **characterised in that** the zone (11) of the haptic element (1, 1', 1'') associated with the switch elements (21, 21', 22, 22', 23, 24, 24') forms at the same time at least one operating element of the haptic element (1, 1', 1'').
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SWITCH TO BE MOUNTED ON A DESIGN ELEMENT IN THE PASSENGER
COMPARTMENT OF A MOTOR VEHICLE

5

Description

- 10 The invention relates to a switch to be mounted on a design element in the passenger compartment of a motor vehicle according to the preamble of patent claim 1. The switch according to the invention is characterised by a simple secure assembly process as well as by its
- 15 significant lack of dependence on the design of the haptic element.

- By haptic element is meant a structural group of the switch which contains the mechanical operating elements
- 20 required for manually operating the switch. The haptic element can furthermore serve as a visual element, eg by suitably configuring the haptic element it is possible to make the function of the switch visible to the user.

- 25 From DE 197 38 656 A1 a switch is already known whose electrical or electronic switch elements and whose associated operating elements in the haptic element are positioned independently of each other on various parts of the vehicle door. They only come into active connection
- 30 after the two parts have been fitted together. The drawback here however is that it is necessary to ensure a very close tolerance of the parts which support the switch element and haptic element which are to be connected together otherwise faulty positioning may have to be taken
- 35 into account.

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DE 43 13 030 A1 and US 5 805 402 describe groups of switches based on flexible printed conductors. They consist essentially of electrical switch elements which can preferably be in cases which are assigned a flexible foil touch panel or separate operating elements held in a console. Even with this technical solution bringing together the electrical switch elements and the haptic element requires considerable effort and great care. Furthermore switch blocks of this kind combined into groups considerably restrict the freedom of design since the geometrical arrangement of the individual switch elements determines the positioning of the operating elements of the haptic element. With many design specifications, such as are customary in the automotive industry, there is a great degree of variation in the foil-bound switch elements, unless one always proceeds from the variation having the highest design specification and does not connect up the corresponding switches where the design specifications are lower. However this leads to an undesirably high use of resources.

The object of the invention is to provide a switch to be mounted on a design element in the passenger compartment of a motor vehicle, for example on the inner trim of a door, which is cost-effective to manufacture and which can be fitted simply and securely and which can be adapted to any desired design.

According to the invention this is achieved through the features of patent claim 1.

According to this the zones of the flexible conductor which support the switch elements, and the zones or operating elements of the haptic element which are associated with these zones are designed so that the relevant zones can be positioned and fixed relative to each other and can be detached from each other. Furthermore these zones have no means for establishing a

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permanent electrical circuit connection. Thus no permanent electrical contact is produced between the zones on the two sides.

- 5 The term "electrical" and "electronic" switch elements is thereby to include electro-magnetic and electro-optical switch elements.

- 10 According to a variation of the invention it is hereby proposed that the haptic element cannot be brought into an electrically conductive connection with the switch elements, i.e. the haptic element has no electrically conductive component parts which can be coupled electrically with the switch elements.

- 15 According to another variation of the invention the haptic element can only be brought into electrically conductive connection with the switch elements by actuating an operating element of the haptic element whereby the
20 electrically conducting connection only exists for as long as the switch is located in the switching state produced by actuating the operating element ("switch closed"). With this variation of the invention the haptic element has no electrical structural elements in the narrower
25 sense (such as e.g. a resistance, a transistor etc), but only a contact bridge in the form of a simple electrical conductor with which an electrical connection can be established between two switch elements.

- 30 According to a preferred embodiment of the invention the relevant zones of the conductor and haptic element are formed as mechanical plug connectors wherein a base member of the haptic element has a socket zone, such as e.g. a plug opening with which the zone of the flexible conductor
35 supporting the switch elements can be brought into positive keyed engagement. To this end the zones of the flexible conductor supporting the switch elements has a mechanical reinforcement in the form of a frame around the

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edges, a plate at the back or a cast element incorporating the relevant zone.

5 A cast element is suitable when using contactless switch systems, such as magneto-resistive sensors or inductive and capacitive close-range approach sensors. The cast element thereby offers in addition to good protection against mechanical damage also excellent protection against chemical attack and obviously against damp. This
10 in turn guarantees that the switch has a high reliability and long service life.

Through suitably configuring the reinforcement which is connected to the flexible conductor, and also the close-
15 fitting corresponding socket opening in the haptic element, the plug connection can only be established in the proposed position. Forming the reinforcement, whether it is by sticking a plate onto the reverse side of the conductor or by injection moulding a frame round the edge
20 of the conductor or by casting the end region of the conductor, can be undertaken with high precision and efficiency by automated machines.

The mechanical reinforcements can also have detent
25 elements for securing the insert position with regard to the haptic element, as well as means for sealing the plug-in zone against damp. When manufacturing such components it is possible to use twin component plastics injection moulding technology so that it is easier to meet the
30 demands required for a seal through the softer of the two plastics.

A further embodiment of the invention proposes designing the zones of the flexible conductor supporting the
35 switches, and the associated zone of the haptic element as a clamp-fit connection whereby a base body of the haptic element has a socket zone and a fixing element connectable therewith so that the zone of the flexible conductor

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supporting the switch elements can be clamped between the socket zone of the haptic element and the fixing element. This can be undertaken for example by a fixing element which is connected in one piece with the base body through
5 a film hinge of a plastics base body of the haptic element. After the corresponding zone of the flexible conductor has been supplied to the socket zone of the base body the fixing element can be swivelled towards the socket zone until its position is secured through detent
10 elements and the conductor is thereby fixed with the switch elements relative to the position of the operating elements.

A further development of this embodiment proposes using a
15 separate clamping plate as the fixing element. In this case the clamping plate should be provided with positive locking elements (e.g. studs) which are associated with matching detent openings (preferably around the edge) of the flexible conductor. These positive locking elements
20 can be arranged so that only an exact positioning is possible between the clamping plate and conductor. The clamping plate is then fixed on the base body of the haptic element by means of a snap-fitting connection.

25 Basically all types of switch elements can be used if they are suitable for fitting flexible printed conductors. These can be formed for example as electrical contact faces which are allocated an electrical contact bridge which is connected to an operating element of the haptic
30 element and closes the electric circuit when the operating element is actuated. Apart from the inductive and capacitive close-range approach switches and magneto-resistive structural elements (e.g. Hall element) already mentioned and which are each assigned a ferro-magnetic
35 metal plate or a permanent magnet connected to an operating element of the haptic element, boxed switch elements are also suitable in the form of SMD switches or switch mats. Furthermore transponder readers are also

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suitable as switch elements. Which type of switch is selected by the technician depends decisively on the technical requirements in each individual case.

5 At this point it should be pointed out that non-electrical principles can be used. By way of example the switch elements provided on the flexible conductor can be formed as passive or active optical elements which are assigned on the side of the operating elements of the haptic
10 element means for reflection for the purpose of establishing an optical transmission path or means for interrupting an optical transmission path. Further processing of the switch signal is undertaken through the interposition of an opto-electrical converter.

15 Next to the switch elements there are where necessary further structural elements such as for example an optical element for lighting up the switch, a micro controller, resistances, diodes or the like.

20 The invention utilises the principle of the plug connection in order to establish in a simple reliable way an active connection between the switch elements and the operating elements of the haptic element without using at
25 the same time (permanent-acting) electrical cable connections which are liable to breakdown. The configuration of the zones of the flexible conductor supporting the switch elements is entirely secondary to the configuration of the haptic element whilst
30 simultaneously reducing the variety of designs on the switch side. I.e by means of the technical solution according to the invention (theoretically) any number of geometric arrangements of the operating elements of the haptic element can be fitted with only one variation of
35 cable harness.

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The invention will now be explained in further detail with reference to the embodiments shown in the drawings in which:

- 5 Figure 1 shows a flexible conductor with a reinforcement formed as a plate on the reverse side as well as boxed switch elements on the front side and haptic element with operating elements prior to connection with the switch;
- 10 Figure 2 is as Figure 1, but with electrical contact faces as the switch element;
- Figure 3 shows a flexible conductor for clamp fitting on the base body of the haptic element by means of a clamping plate which is swivel mounted on the
- 15 Figure 4 similar to Figure 3, but with a separate clamping plate;
- Figure 5 shows a diagrammatic illustration of a flexible conductor with a close-range approach switch or the like wherein the plug area is formed by a
- 20 Figure 6 shows a diagrammatic view of a flexible conductor with switch elements in the form of a boxed touch panel and a plug zone formed as a cast element wherein the cast element has
- 25 Figure 7 shows a diagrammatic view of a flexible conductor with a reinforcement plate stuck onto the underneath to form the plug zone;

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Figure 8 shows a diagrammatic view of a flexible conductor with a plug zone formed by a frame around the edge;

5 Figure 9 shows a diagrammatic view of a flexible conductor with a plate moulded onto the underneath and with a sealing element closing the plug zone, as well as with detent elements fixing the plug-in position in the haptic element;

10 Figure 10 shows a diagrammatic view of a flexible conductor with a clamping zone which has perforations for positioning the switch elements accurately relative to the haptic element;

15 Figure 11 shows a diagrammatic view of a flexible conductor which is divided up into three arms with plug zones at the ends for different functioning units.

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20 Mounting electrical and electronic structural elements 3a, 3b, 21, 22, 23, 24 on flexible conductor plates or conductors 2, 2a, 2b, 2c is carried out by automatic manufacturing equipment which can be adapted to the various different requirements of the component parts which are to be fitted. Thus it can also be envisaged
25 that the plug zones 20 or clamping zones 20' can be formed in the same production line. The relevant zones are then immediately available for connecting to a suitably adapted haptic element.

30 Figure 1 shows a flexible conductor 2 having conducting paths 200 to which are connected two boxed switch elements 21, 21' (constructed as buttons) and an optical element 3a (e.g. light diode) for illuminating the switch. On the back of the conductor 2 there is a reinforcement 123 in
35 the form of a plate which is stuck on and stabilises the plug zone 20 which supports the switch elements 21, 21' and is associated with a slit-like plug zone 12 of the base body 10 of the haptic element 11. Detent and sealing

elements can, analogous with Figure 9, be connected to the reinforcement 123 to ensure secure fixing of the plug zone 20 in the haptic element as well as an effective seal against damp.

5

After introducing the plug zone 20 into the socket zone 12 of the base body 10 of the haptic element 1 an active connection is established between the switch elements 21, 21' and the operating element 11. If finger pressure is applied to one of the zones of the operating element 11 marked by the arrows ((or ()) then this zone flips in the direction of the corresponding switch element 21 or 21' and thereby actuates the sensor element 21a which leads to a switch signal. Once the operating pressure has ceased the operating element 11 automatically returns to its starting position whereby the switch signal is interrupted.

The embodiment of Figure 2 corresponds substantially to that of Figure 1. Only the switch elements 22, 22' are designed as electrical contact faces which are each assigned a contact bridge (not shown) from the inside of the operating element 11. A switch signal is thus produced by short-circuiting the adjoining and slightly spaced contact faces 22 and 22'. When using this embodiment in surroundings which are susceptible to damp and possibly to particles of dirt, e.g. in the wet space of a vehicle door, a seal has to be provided around the edge of the socket area 12 of the haptic element 1. For this not only are the means available which are already mentioned in the description relating to Figure 1, but also there is the possibility of integrating a seal (e.g. through 2-component injection moulding) in the base body 10 of the haptic element since the switch elements 22 which are formed as contact faces do not really cause any extra thickness compared with the boxed switch elements 21 (see Figure 1) which might hinder the insertion of the plug zone 20 into the base body 10.

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The variation of the invention shown in Figure 3 uses a clamping connection instead of a plug-in connection between the conductor 2 and haptic element. According to the variation here a fixing element 12' designed as a clamping plate is attached to the base body 10 of the haptic element 1' through a film hinge 12b and after positioning the clamping zone 20 of the flexible conductor 20 relative to the socket zone 120 of the haptic element 1' the fixing element can be fixed on the base body 10 through the detent elements 10a, 12a. This produces a clamping fixing of the conductor 2 on the haptic element 1'. The film hinge 12b could be used as a stop for correctly positioning the conductor 2.

As opposed to this, the switch in Figure 4 uses a separate fixing element 12'' which should preferably be provided with positive locking elements (not shown) which can engage in positioning openings of the flexible conductor (analogous with Figure 10). After clipping the fixing element 12'' onto the base body 1' a permanently correct positioning of the switch elements 22, 22' relative to the operating element 11 is guaranteed.

When using a clamping connection between the zone 20' and the base body 10 a mechanical reinforcement is no longer required.

Figure 5 shows a mechanical reinforcement 121 in the form of a case element (e.g. based on an epoxy resin or plastics) which completely encases the plug zone and in which an electronic contactlessly operating switch 23 (e.g. Hall element) is embedded which reacts to close range approach of the associated zone of the operating element 11 or a part connected thereto. Furthermore an optical element is provided for illuminating the switch.

In the embodiment of Figure 6 recesses were provided in the case element 122 in the region of the switch elements 24, 24' formed as buttons (analogous with Figure 1), to allow access and thus operation through the operating element 11. Depending on requirements further electronic structural elements 3b are included in the cast element. In order to reliably avoid a false execution of the plug fitting process the contours of the mechanical reinforcements 121, 122, 123, 124, 125 and socket openings 12 of the base body 10 should be matched with each other along the lines of the key principle.

Figure 7 corresponds substantially to a combination of the mechanical reinforcement 123 of Figure 1 and the fitting out of electronic structural elements according to Figure 5.

Figure 8 shows a mechanical reinforcement in the form of a frame 124 which is connected to the side edge of the conductor 2, for example by injection moulding or even by sticking.

The reinforcement shown in Figure 9 consists of a plate 125 connected to the underneath of the conductor and provided on its inner edge with a moulded seal 125a having detent elements 125b. In conjunction with a haptic element similar to Figure 1 and adapted detent elements of the base body it is possible to guarantee a permanent secure positioning of the switch elements 22, 22' relative to the operating element 11. The seal 125a keeps out dirt and damp from the electrical and electronic structural elements.

One example of a flexible conductor 2 for clamp fixing on a haptic element is shown in Figure 10. According to this perforations 126 are formed in the clamping area 20' of the conductor 2 and are associated with detent pins (not shown) on a fixing element 12''. The different patterns of perforations 126 in the two edges guarantees accurate positioning of the conductor 2 relative to the fixing element 12'' and thus also to the operating element 11.

- 10 The diagrammatic illustration of Figure 11 shows a conductor 2 split up into three conductor arms 2a, 2b, 2c. The end zones 4, 5, 6, 7 are each assigned different functions. For a cable inserted in a vehicle door on the drive side for example the zone could be connected to a switch module which is provided for operating the front and rear window lifters, the mirror and the child lock. Unlocking the petrol tank could be assigned to the zone 5 of the conductor arm 2b. Finally the zones 6 and 7 can be connected to indicator instruments showing the state of the door locks.
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LIST OF REFERENCE NUMERALS

	1	Haptic element
	1'	Haptic element
5	1''	Haptic element
	10	Base body of haptic element
	10a	Detent element
	11	Operating element, sensor button
10	12	Socket zone, plug zone
	12'	Fixing element; plate, integrated and swivel mounted in base body
	12''	Fixing element; plate, separate
	12a	Detent element
15	120	Socket zone
	121	Cast element
	122	Cast element
	123	Reinforcement element, full surface on one side
20	124	Reinforcement element, around the edges
	125	Reinforcement element, full surface on one side
	125a	Sealing element
	125b	Detent element, clip element
	126	Positioning means, recess, perforation
25	2	Flexible conductor
	2a	Flexible conductor
	2b	Flexible conductor
	20	Zone supporting switch elements; plug zone
30	20'	Zone supporting switch elements; clamping zone
	21	Switch element
	21a	Sensor element
	22	Switch element
	23	Switch element
35	24	Switch element
	200	Conductor path

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- 3a Optical element
- 3b Electronic component part (any type)
- 4 Zone associated with haptic element
- 5 Zone associated with haptic element
- 5 Zone associated with haptic element
- 6 Zone associated with haptic element
- 10 7 Zone associated with haptic element

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PATENT CLAIMS

1. Switch to be mounted on a design element in the
5 passenger compartment of a motor vehicle, with
- a haptic element which has at least one mechanical operating element for the switch, and
 - electric and/or electronic switch elements which are mounted on a flexible conductor,
- 10 wherein the haptic element acts on the switch elements when the operating element is actuated,

characterised in that

- 15 the zone (20) of the flexible conductor (2, 2a, 2b) supporting the switch elements (21, 21', 22, 22', 23, 24, 24') and an associated zone (11) of the haptic element (1, 1', 1'') are configured so that the corresponding zones (11, 20) can be positioned and fixed relative to each
- 20 other whilst no permanent electrical conductive connection is established between the flexible conductor (2, 2a, 2b) and the haptic element (1, 1', 1'').

2. Switch according to claim 1 **characterised in that** the
- 25 haptic element (1, 1', 1'') cannot be brought into electrically conductive connection with the switch elements (21, 21', 22, 22', 23, 24, 24').

3. Switch according to claim 1 or 2 **characterised in that**
- 30 the haptic element (1, 1', 1'') has no electrically conductive component parts which can be coupled electrically with the switch elements (21, 21', 22, 22', 23, 24, 24').

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4. Switch according to claim 1 **characterised in that** the haptic element (1, 1', 1'') can only be brought into electrically conductive connection with the switch elements (21, 21', 22, 22', 23, 24, 24') by actuating an operating element (11) of the haptic element (1, 1', 1'').

5. Switch according to claim 4 **characterised in that** the electrically conductive connection only exists for as long as the switch is located in the switching state established by actuating the operating element (11).

6. Switch according to claim 1, 4 or 5 **characterised in that** the haptic element (1, 1', 1'') has no electrical structural elements apart from an electrical conductor.

7. Switch according to claim 1, 4, 5 or 6 **characterised in that** the haptic element (1, 1', 1'') has as a single electrically conductive component which can be coupled electrically with the switch elements (21, 21', 22, 22', 23, 24, 24') a contact bridge with which an electrical connection can be established between two switch elements (21, 21', 22, 22', 23, 24, 24').

8. Switch according to one of the preceding claims, **characterised in that** the relevant zones (11, 20, 20') of the conductor (2, 2a, 2b) and the haptic element (1) are formed as mechanical plug connectors wherein a base body (10) of the haptic element (1) has a socket zone (12) with which the zone (20, 20') of the flexible conductor (2) supporting the switch elements (21, 21', 22, 22') can be brought into positive engagement.

9. Switch according to claim 8 **characterised in that** the zone of the flexible conductor (2) supporting the switch elements (21, 21', 22, 22', 23, 24, 24') has a mechanical reinforcement (121, 122, 123, 124).

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10. Switch according to claims 8 and 9 **characterised in that** the mechanical reinforcement is formed as a frame (124) around the edges, a plate (123, 125) at the back or a cast element (121, 122) which surrounds the relevant zone (20).

11. Switch according to one of the preceding claims **characterised in that** the mechanical reinforcement has at least one detent element (125b) for securing the insert position in respect of the haptic element and/or means (125a) for sealing the plug zone against damp.

12. Switch according to one of claims 1 to 7 **characterised in that** the relevant zones (11, 20') of the conductor (2) and haptic element (1', 1'') are formed as clamp-fit connections wherein a base body (10) of the haptic element (1', 1'') has a socket zone (120) and a fixing element (12', 12'') connectable therewith so that the zone (20') of the flexible conductor (2) supporting the switch elements (22, 22') can be clamped between the socket zone (120) of the haptic element and the fixing element (12', 12'').

13. Switch according to claim 12 **characterised in that** the fixing element (12') is connected in one piece with the base body (10) through a film hinge (12b) of a plastics base body (10) of the haptic element (1').

14. Switch according to claim 11 **characterised in that** the fixing element (12'') is formed as a separate clamping plate.

15. Switch according to claim 12 **characterised in that** means are provided for positioning the zone of the flexible conductor supporting the switch elements relative to the base body of the haptic element.

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16. Switch according to claim 15 **characterised in that** the positioning means are formed on the part of the flexible conductor (2) in the form of recesses (126) and on the part of the base member of the haptic element in
5 the form of corresponding studs or the like.

17. Switch according to one of the preceding claims **characterised in that** the switch elements (22, 22') provided on the flexible conductor (2) are formed as
10 electrical contact faces which are allocated an electrical contact bridge which is connected to an operating element (11) of the haptic element (1) and which when the operating element (11) is actuated closes the electrical circuit.

15 18. Switch according to one of the preceding claims **characterised in that** the switch elements (24, 24') provided on the flexible conductor (2) are provided in boxes, e.g. in the form of SMD switches or switch mats.

20 19. Switch according to one of the preceding claims **characterised in that** the switch elements provided on the flexible conductor (2) are designed as magneto-resistive structural elements (e.g. Hall elements) which are each
25 allocated a permanent magnet which is connected to an actuating element of the haptic element.

30 20. Switch according to one of the preceding claims **characterised in that** the switch elements provided on the flexible conductor (2) are formed as inductive or capacitive close range approach switches.

35 21. Switch according to one of the preceding claims, **characterised in that** the switch elements provided on the flexible conductor (2) are formed as transponder readers.

22. Switch according to one of the preceding claims **characterised in that** the switch elements provided on the

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flexible conductor (2) are formed as passive or active optical elements allocated on the part of the operating elements of the haptic element means for reflection for the purpose of establishing a visual transmission path or
5 means for interrupting a visual transmission path.

23. Switch according to one of the preceding claims **characterised in that** further structural elements (3a, 3b) such as for example an optical element for illuminating
10 the switch, a micro controller, resistances, diodes or the like, are mounted on the zone (20) of the flexible conductor (2) supporting the switch elements.

24. Switch according to one of the preceding claims **characterised in that** the zone (20) supporting the switch
15 elements is detachably connected to the haptic element (1, 1', 1'').

25. Switch according to one of the preceding claims **characterised in that** the switch has in addition to the
20 switch elements (21, 21', 22, 22', 23, 24, 24') also further electrical and/or electronic structural elements.

26. Switch according to one of the preceding claims **characterised in that** the zone (11) of the haptic element
25 (1, 1', 1'') associated with the switch elements (21, 21', 22, 22', 23, 24, 24') forms at the same time at least one operating element of the haptic element (1, 1', 1'').

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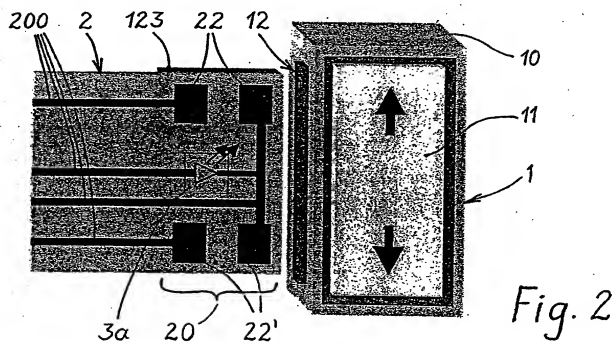
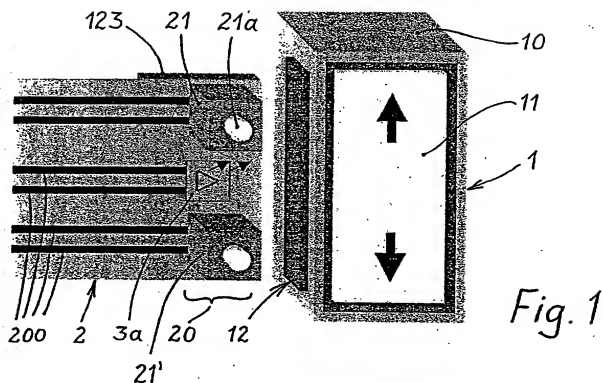


Fig. 3

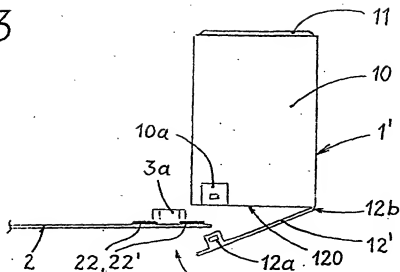
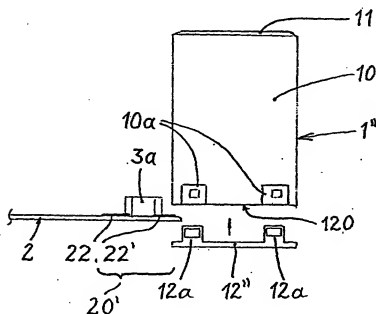
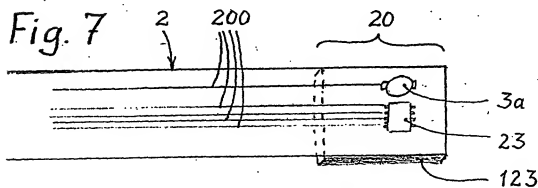
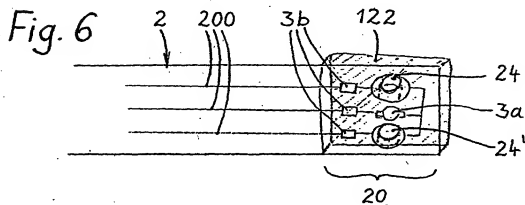
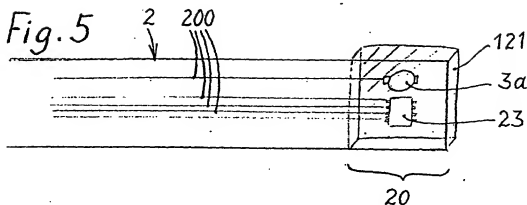
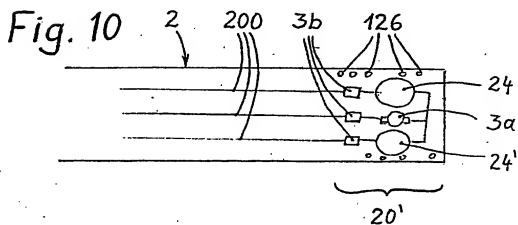
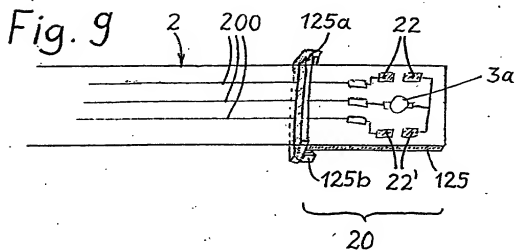
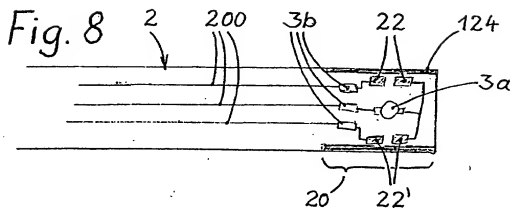


Fig. 4





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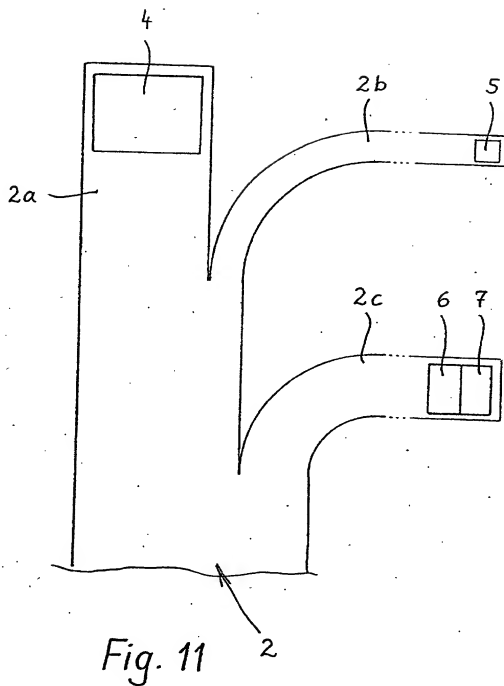


Fig. 11

Rev. 11/00

DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION

PATENT

Docket No.: 47861/DBP/M621

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled SWITCH TO BE MOUNTED ON A DESIGN ELEMENT IN THE PASSENGER COMPARTMENT OF A MOTOR VEHICLE, the specification of which is attached hereto unless the following is checked:

☒ was filed on August 18, 2000, as United States Application Number or PCT International Application Number PCT/DE00/02863 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of the foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States of America, listed below and have also identified below, any foreign application for patent or inventor's certificate, or any PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

<u>Application Number</u>	<u>Country</u>	<u>Filing Date (day/month/year)</u>	<u>Priority Claimed</u>
199 40 172.1	Germany	24 August 1999	YES

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below.

<u>Application Number</u>	<u>Filing Date</u>
---------------------------	--------------------

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112.

<u>Application Number</u>	<u>Filing Date</u>	<u>Patented/Pending/Abandoned</u>
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POWER OF ATTORNEY: I hereby appoint the following attorneys and agents of the law firm CHRISTIE, PARKER & HALE, LLP to prosecute this application and any international application under the Patent Cooperation Treaty based on it and to transact all business in the U.S. Patent and Trademark Office connected

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**DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION**

Docket No. 47861/DBP/MS21

with either of them in accordance with instructions from the assignee of the entire interest in this application; or from the first or sole inventor named below in the event the application is not assigned; or from MAIKOWSKI & NINNEMANN, in the event the power granted herein is for an application filed on behalf of a foreign attorney or agent.

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I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION

Docket No. 47861/DBP/M521

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